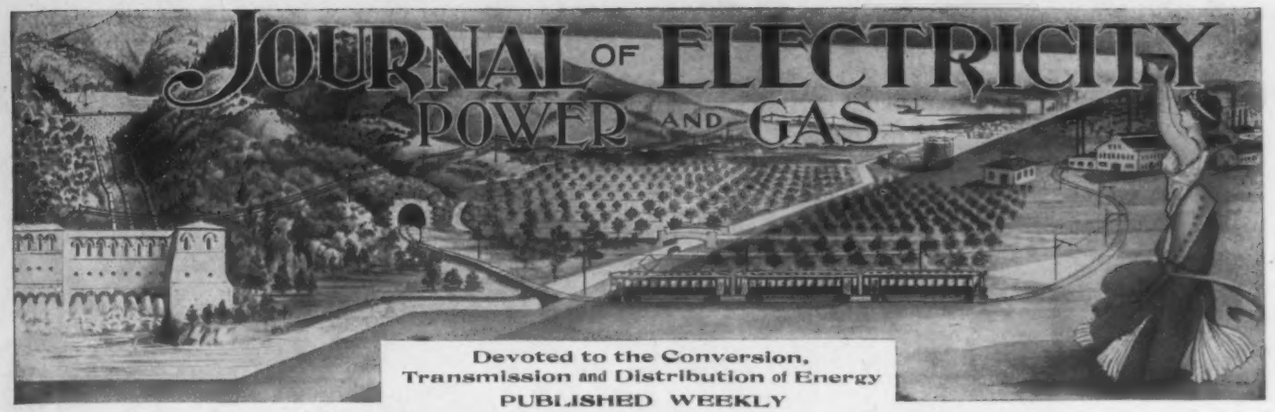

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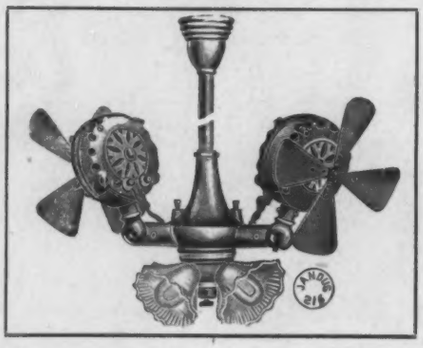

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THE

Journal of Electricity, Power and Gas

Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XX. SAN FRANCISCO, CAL., APRIL 18, 1908 No. 16

SINGLE PHASE RAILWAY.

SAN FRANCISCO, VALLEJO & NAPA VALLEY RAILROAD.

The following paper and discussions were read by Mr. Wm. F. Lamme at the March 27th meeting of the San Francisco Section of the American Institute of Electrical Engineers:

Paper by Wm. F. Lamme.

In 1904 a contract was executed between Captain John Cross of Los Angeles and the Westinghouse Electric & Mfg. Company, for electrical apparatus to equip a railway running between Vallejo and Napa, California.

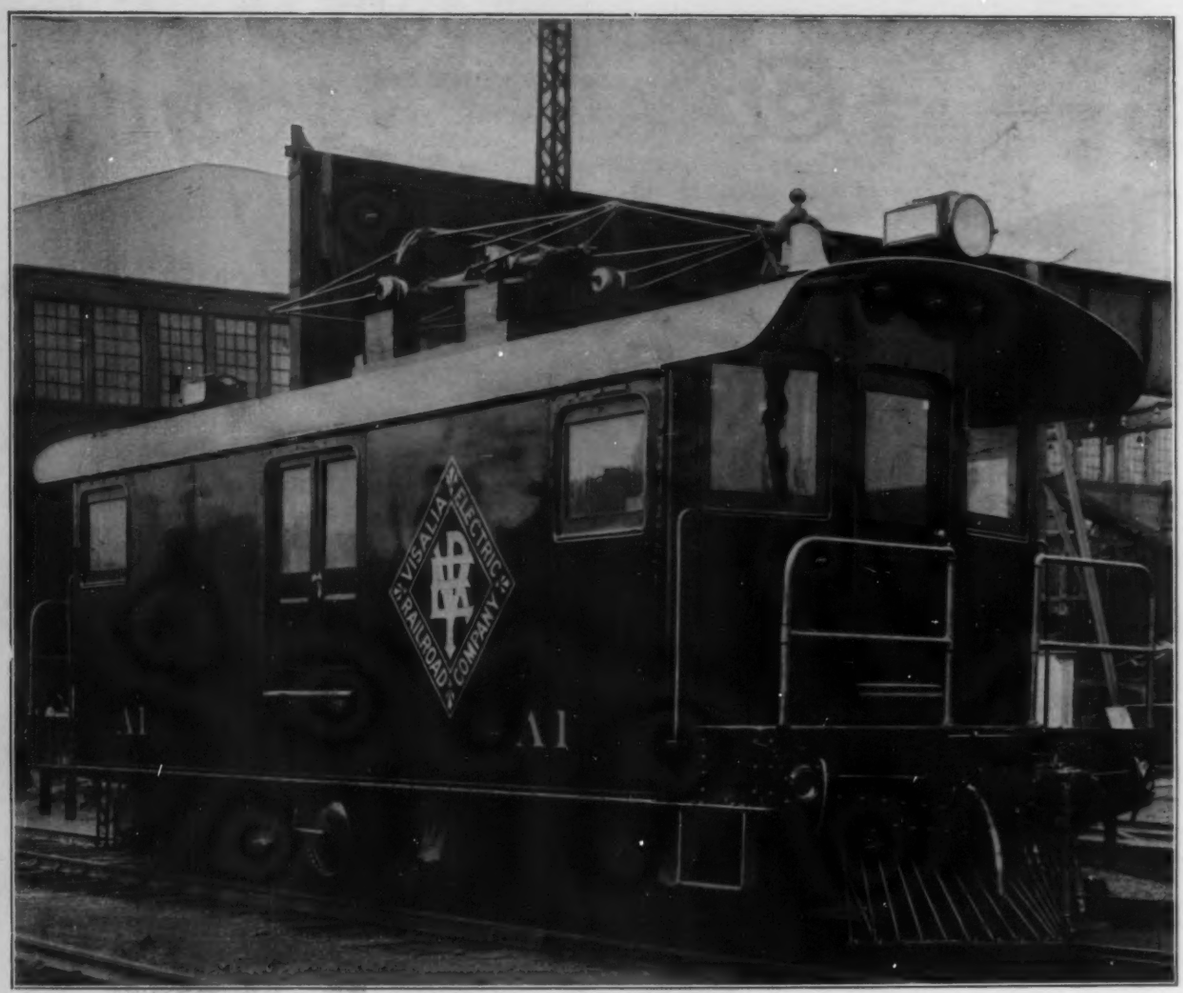
This electrical equipment is the so-called single phase 25 cycles. The powerhouse is located at Napa, near one end of the original line.

The apparatus as first furnished consisted of the following:

Power House.—Two Motor Generators. The motor, 585 horse-power, 2200 volts, 3 phase, 60 cycles, to operate off the lines of the California Gas & Electric Corporation.

The generator.—400 kilowatt, 6600 volts, two phase, 25 cycles, to deliver single phase current to each of two insulated sections of the trolley system.

One switchboard to measure and operate the above two motor generator sets.



WESTINGHOUSE SINGLE PHASE LOCOMOTIVE.

Line.—For feeding the trolley system there were furnished: Five transformers, each 200 kilowatt, 25 cycles, 6600-750 volts.

Car Equipments.—Motor equipment for the cars were furnished as follows:

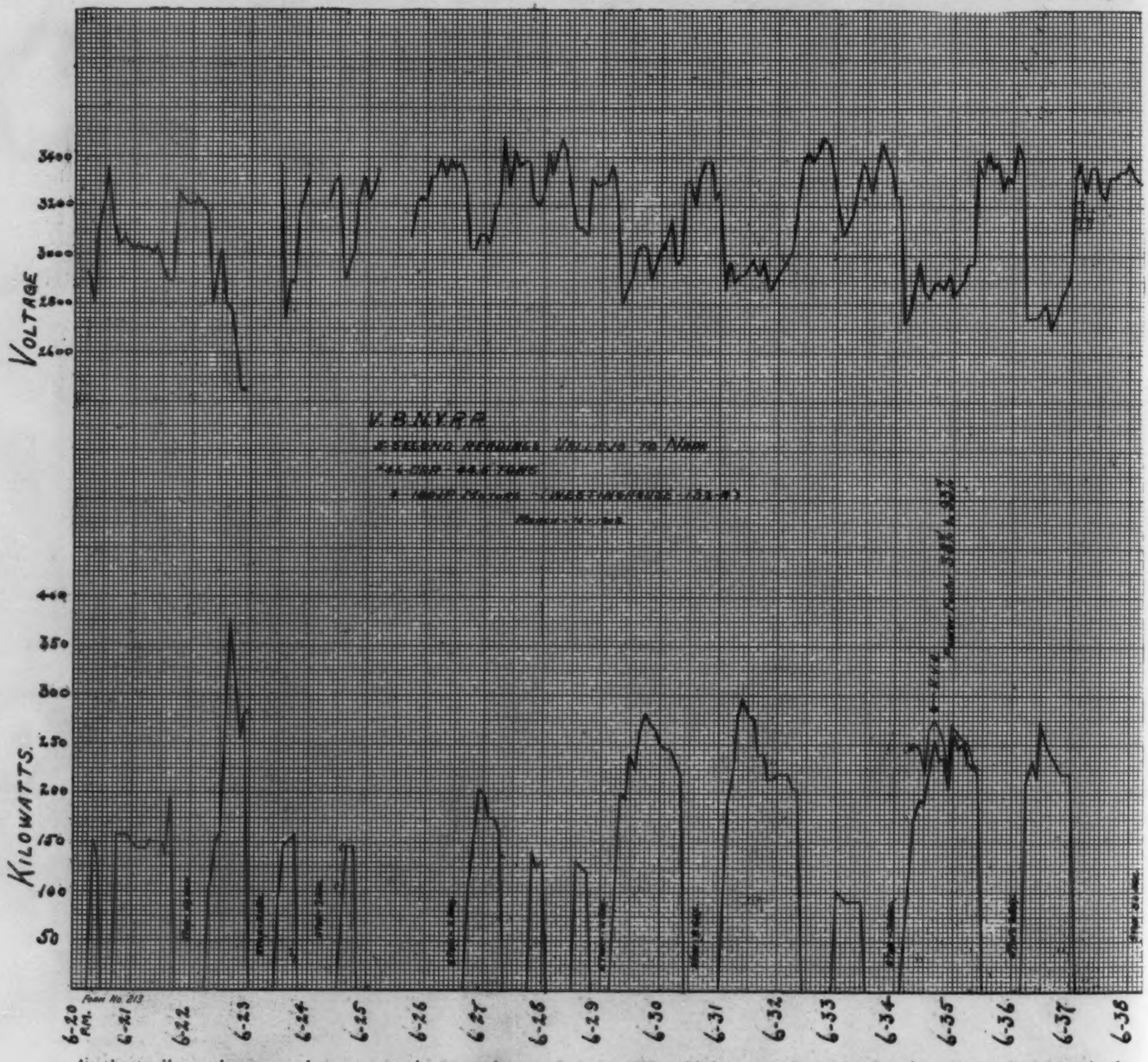
Three four-motor equipments, each 25 cycles, No. 106, normal rating, 100 horse-power.

Two four-motor equipments, each 25 cycles, No. 107, normal rating, 75 horse-power.

As first installed, the trolley line voltage was 750, the control was made by the induction regulator method; there was a seven per cent grade for thirteen miles from the power house, and the nearest step-down transformer was located nearly a mile away from the seven per cent grade.

with large sleeve insulators, also the pantagraph trolley was substituted for the standard pole and wheel.

Later, the generators were re-wound to deliver 6600 volts, single phase, instead of 6600 volts, two phase, and by the use of a superior kind of insulation, which took up but little space, sufficient room was secured for copper to keep the rating on these generators up to 400 kilowatts.



As the trolley voltage was low, gear ratios were improper for the service, and an induction regulator control was used. Coupled with this, a heavy grade distant from the power supply and improper first location of a step-down transformer, made this equipment unsuccessful in operation. Therefore, immediately, plans were agreed upon to make many changes.

The gear ratios were changed, the trolley voltage was raised from 750 to 3300 volts, and the control was modified from induction regulator to unit switch. Instead of five transformers, each 200 kilowatt capacity, two transformers of 500 kilowatt capacity each were substituted, one placed in the power-house, and one placed near Vallejo, within a mile of the grade referred to above. Of course, with 3300 volts on the trolley, the trolley construction was changed from standard 500 volts to catenary of the well known Westinghouse type

The chief reason for changing from two phase to single phase was the one of voltage regulation. With two phase, you perceive that it is impossible to control the voltages on both phases unless the loads agree fairly well. On the Napa Valley railway system, the phases unbalanced badly, so it was concluded to re-wind for single phase, the single phase voltage to be regulated by the use of a Tirrill regulator. This plan produced very satisfactory results.

After the modifications noted above, the service given was most excellent, and so satisfactory that the local company bought five more equipments, known as 132-A, a new design of the old No. 106.

About one month ago, wattmeter readings were taken upon the new 132-A equipments. The wattmeter used is of the standard recording type. The moving parts of this meter

are very light and the friction is exceedingly small, therefore, the errors in the readings due to vibration or jostling of the car must be very slight, if not negligible. The average over 4500 miles, running in regular service, gave a result of 89 watt hours per ton mile, and with line losses approximately ten per cent, then watt hours per ton mile at switchboard = 98. From the paper in your hands, you note the ratio of input to output of the motor generator set, ranges from 1.5 to 1—to 1.67 to 1. Taking an average of 1.6 to 1, then the watt hours per car mile at input to motor of motor generator set = 98x1.6=157.

There are several interesting features in connection with this road which should be noted.

1. The wattmeter readings are not largest at start, but rise to a maximum after the car has started. With the D. O. this is somewhat different, as a usual thing.

2. The power factor varies over a wide range from 30 to 95 per cent; lowest at start and rises rapidly with increase of speed.

3. The pentagraph trolley on this road has been modified several times. The nature of these modifications and the durability of different kinds of contact shoes would be a matter of interest.

Discussion by G. R. Murphy.

Through the courtesy of the officials of the Vallejo, Benicia and Napa Valley R. R. Co. we were allowed, on our recent visit to Napa, to go into the records of the car mileage and power consumption. About the latter part of December, the railroad company put into commission some new equipment, so it was decided to select from the records, figures for a period both before and subsequent to the date of change in equipment.

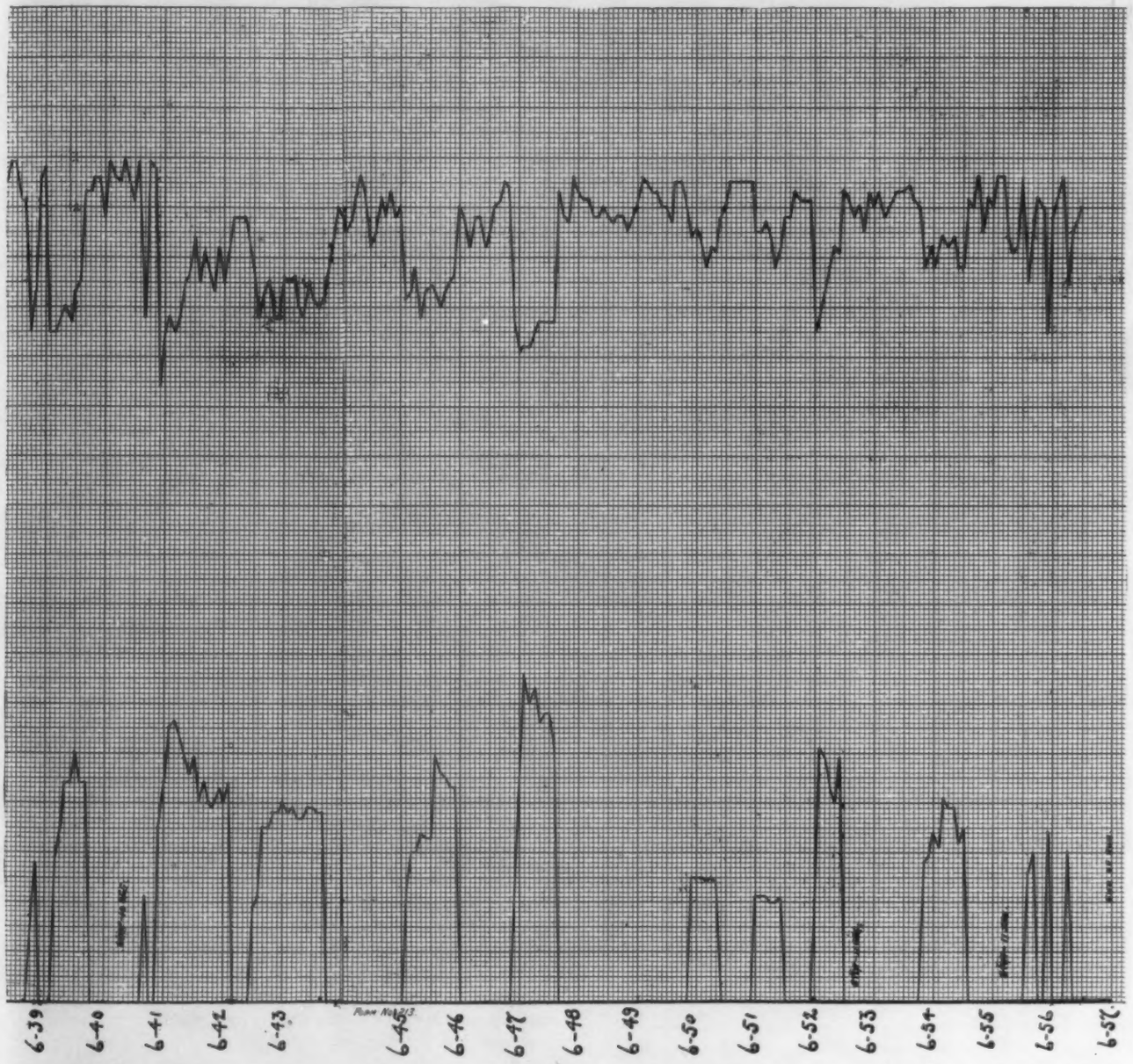


Table No. 1 includes the record of car mileage and kilowatt hour output from November 2nd to November 30th, 1907, inclusive. For this period, the consumption of energy per ton mile was 105 watt hours, and the efficiency between the 3-phase, 60-cycle bus and the 25-cycle, single-phase bus was 60 per cent.

Table No. 2 includes the record of car mileage and kilowatt hour output from March 1st to March 13th, 1908, inclusive. The consumption of energy per ton mile in this case was 108 watt hours, and the efficiency between the 3-phase, 60-cycle bus and the 25-cycle single-phase bus was 66 per cent.

The difference in results in watt hours per ton mile between the twenty-nine days of November, 1907, when the old equipment was operated and the thirteen days in March, when both old and new were being operated, may be partially accounted for by the fact that the new cars seem to be geared too high for the track in its present condition. The lower efficiency in November, 1907, compared with March, 1908, was due to the amount of construction work on hand, making it necessary to run the two motor generator sets the greater part of the time on a comparatively light load.

On the evening of the 14th of March, the committee went over the line between Napa and Vallejo. Car No. 46 was used, and was equipped with indicating wattmeter, voltmeter and ammeter. On the run between Napa and Vallejo, some readings were taken, but the interval of time between readings was too great to make them of any value. From Vallejo to Napa, however, we took five second readings. The wattmeter and voltmeter readings were taken on dead beat instruments, and are, therefore, quite correct. We were not certain, however, of all the ammeter readings except on one cycle. On this cycle, we found the power factor on starting to be 38 per cent, and on the full running speed, 93 per cent.

The curve attached shows these readings in detail.

TABLE I—NOVEMBER 2ND TO NOVEMBER 30TH, 1907, INCLUSIVE.

Car	Weight in tons	Car load in tons	Total weight in tons	Car miles	Ton miles
No. 6	34	2	36	5921	213156
No. 7	34	2	36	3064	110304
No. 8	34	2	36	4440	159840
No. 1	35.3	1.5	36.8	1368	50342
Locomotive	31	-	31	2247	69657
Flat Cars	15	6	21	4454	93534
Trailers	14	2	16	398	6368
Box Cars	29	1.5	30.5	158	4819

Total ton miles=708020

Kilowatt hour output of 25 cycle generators=74400
Watt hours per ton mile=105
Kilowatt hour inpnt of 60 cycle motor generator set=124700
Efficiency from 3 phase 60 cycle to the single phase 25 cycle bus=60%
Car No. 6=passenger
Car No. 7= "
Car No. 8= "
Car No. 1=Baggage

Flat Cars used on construction work and it was assumed that they carried 12 tons and loaded only 50% of the time.

TABLE II—MARCH 1ST TO MARCH 13TH, 1908, INCLUSIVE.

Car	Weight in tons	Car load in tons	Total weight in tons	Car miles	Ton miles
No. 7	34	2	36	1106	39816
No. 8	34	2	36	1579	56844
No. 40	44.5	2	46.5	29.1	1354
No. 42	44.5	2	46.5	169.5	7882
No. 45	44.5	2	46.5	2113.4	98273
No. 46	44.5	2	46.5	2368.7	110415
No. 1	35.3	1.5	36.8	101.4	3732
No. 100	44.5	1.5	46	640.2	2945
Locomotive	31	-	31	992	30752
Flat Cars	15	6	21	1784	37464

Total ton miles=389477

Kilowatt hour output of 25 cycle generators=42000
Watt hours per ton mile=108
Kilowatt hour input of 60 cycle motor generator sets=63700
Efficiency from 3 phase 60 cycle to the single phase 25 cycle bus=66%
Car No. 7=passenger
Car No. 8= "
Car No. 40= "
Car No. 42= "
Car No. 45= "
Car No. 46= "
Car No. 1=Baggage
Car No. 100= "
Flat cars loaded with 12 tons 50% of the time.

Discussion by Geo. A Hearn, Chief Electrician.

In view of the fact that the operating conditions of this road were recently investigated by a committee of interested members of the A. I. E. E., I would like to present a statement regarding the maintenance of our A. C. Ry. equipments, and in doing so, would refer you to a statement published in the proceedings of February, 1907. In this issue there were assertions made regarding the maintenance of equipment which were greatly misleading, and the economic conditions were misrepresented, while the difficulties under which we were operating at that time were not mentioned at all.

It was stated in a general way that eight men were required to keep five motor cars in repair, and no mention was made of the distribution of this labor, but the reader was lead to believe that a large majority of this work was performed in maintenance of electrical equipment. In fairness to the company whose apparatus is in use on this road, I present a few figures which will show the comparison between the cost of maintaining electrical apparatus, as compared with the principal item of expense at the time this investigation was made.

For three months preceding the time this information was obtained, a total of 2321 hours work was performed on car bodies, trucks, and freight equipment, against a total of 484 hours' work on electrical equipment, and this included the remounting of electrical apparatus which had received mechanical injury while on the road.

The classification of the men referred to was as follows: switchboard operators, two; machinist, one; blacksmith and helper, two; inspector, one; helper, one; car cleaner, one.

These figures are obtained from our record of distribution of operating expenses for September, October and November, 1906, at a time when we were operating under very adverse conditions, due to an unballasted roadbed and a shortage of equipment.

The records for this period also show that one-third of the time of two of these eight men was expended on repairs and construction of track tools, drills, etc.

Since this time our equipment, both freight and passenger, has been more than doubled, and we expect to handle the work in our shop and barns with this same force, and in a more satisfactory manner than during the period referred to above.

In closing, I would like to state that the first of our new equipments has been in service since December 23, 1907, and since this date has run 14,735 miles, requiring a total of five hours' work on repair to electrical apparatus, and this was caused by the carelessness of an employee.

I do not include data regarding cost of power, as you already have a record of recent tests which will, I believe, be deserving of some consideration.

In investigating the cost of maintenance and other details of the single phase motor equipment, we find that the average cost of maintenance, repairs and sub-station operators, is approximately $540 per month. This amount includes maintenance and repair of overhead work, telephone, cars, trucks, motor equipment, inspection and car cleaning.

The average daily mileage is as follows:

1 passenger car	182 miles
1 passenger car	164 miles
1 passenger car	81 miles
1 passenger car	130 miles
1 baggage car	65 miles
Work train locomotive	86 miles

After careful inspection of the track, it would appear that the maintenance of rolling stock is very nominal, and if the track were put in first-class condition, this amount would be somewhat reduced. There is absolutely no question but that the poor condition of the track increases the maintenance account on trucks and equipment.

The maintenance does not seem heavy, as some of the old cars were operated approximately 300 miles per day, previous to the arrival of the new cars.

The maintenance figures given cover the latter part of 1907, and are lower than the maintenance during the period that the reactive control was in service.

We find that there are twenty of the original motors operating which have paper insullation between the segments, and that there are twenty-four later motors which have mica insulation. The motors operate at approximately 303 volts. In the old type equipments, the motors are all in parallel. In the new type equipments, the two motors on each truck are in series. We find that the old equipments heat more than the new equipments, and while there is some change in the design, we believe that this is accounted for in the difference in thickness of the brushes, as in the new equipment the coil s are under short circuit but seventy-five per cent of the time that they are in the older equipments. In the old equipments there are two ½x3-inch brushes per holder, giving a total of three square inches per holder. In the new equipments, there are three ⅜x2⅜ brushes in each holder, giving a total of 2.67 square inches per holder.

The width of the commutator bars in each equipment is the same. It would be interesting to know what the effect would be if narrower brushes were placed on the old equipment. The commutators of both the old and new equipments appear in exceptionally good condition, and in fact, the wear is less than would be expected on a direct current motor of the same capacity which had operated the same number of miles.

The commutators on the work car locomotive have been in practically constant service for approximately three years, and the wear on the commutator has not exceeded one-eighth of an inch.

Steel, copper, and also aluminum sliding contact shoes were used on the pantograph trolley, but the steel shoes have proven most satisfactory, and have been adopted as standard. The steel shoe is four feet long and has an effective contact with the trolley of four inches. The center of the shoe is grooved and is kept full of grease, which acts as a lubricant. Heavy grease is used in the summer time, and lighter grease in colder weather. We inspected one of these shoes which had operated 11,585 miles, and the wear was imperceptible.

We were unable to make micrometer measurements of the trolley, but from a casual inspection this wear is not very much, and cannot be considered a serious matter.

The maintenance of the pantograph trolleys is high on account of the rough condition of the track, often causing the shoe to leave the trolley wire, and when this happens, it generally means a new pantograph. The horns of the shoe at times hook over the trolley wire, but have never damaged the overhead construction.

(To be continued.)

STEAM-DRIVEN ELECTRIC POWER PLANT COSTS.†

Costs of Steam Turbine and Reciprocating Engine Power Plants per Kilowatt Capacity.

	Turbine plants.		Reciprocating engine plants.	
Excavations and foundations	$ 2.00	$ 2.50	$ 3.00	$ 5.00
Building	10.00	15.00	10.00	20.00
Tunnels (condenser water conduit)	1.75	4.00	1.50	2.75
Flues and stacks	2.50	3.50	2.50	3.50
Boilers and stokers	8.50	12.00	8.50	12.00
Superheaters	2.00	2.50	1.75	2.25
Economizers	2.00	2.25	2.00	2.25
Coal and ash handling systems	1.50	3.00	1.50	3.00
Blowers and ducts	1.00	1.50	1.00	1.50
Pumps and tanks	1.00	1.25	1.00	1.25
Piping systems	2.25	4.50	2.50	5.00
Turbo-generators (engines)	22.00	25.00	18.00	22.00
Condensers*	5.00	8.00	3.00	5.00
Exciters	.75	1.00	.75	1.00
Crane	.25	.50	.25	.50
Switchboards	2.00	3.50	2.00	3.50
Plumbing, painting, labor, etc.	1.00	2.00	1.00	2.00
Generators	....	....	10.00	12.00
	$65.50	$92.00	$70.25	$104.50

*Surface condensers for turbine plants; jet condensers for reciprocating engine plants.

To these summarized costs there needs still to be added the engineering fee which in many cases is figured as a percentage on the total cost.

It should be noted that the first and third columns of figures in the table represent costs which are exceptionally low and may be attained under favorable conditions with engineering skill. The second and fourth columns of figures represent fair average figures as ascertained from the costs of a number of plants recently erected. However, plants have been installed which cost as much as $92 per kilowatt. The main items constituting cost approximated $150 per kilowatt.

All of these figures represent costs of plants of large capacity. Small plants of about 3,000 kilowatt capacity have been erected in the West at from $120 to $130 per kilowatt, which costs may be reduced if a simple combination of machines is provided.

Referring to the table, it will be observed that the turbine plant varies from $65 to $92 per kilowatt. The main items constituting this difference are: building turbo-generators and condensers. The difference in cost of these is due to the type of turbine, the size and make of condensers and their auxiliaries, as well as the manner of assembling, all of which may reduce the size of the building required.

The difference in cost of boilers is due to the make or type and the rating of the boiler horsepower adopted by the plant designer per kilowatt capacity. This ratio varies greatly. Plants have been installed with the same type of boiler and the same type of prime mover in which the ratio varies, one value being 0.60 bolier horsepower per kilowatt generator capacity, while in other cases it is 0.75 and 0.80. This difference depends upon the experience and judgment on the part of the designer as well as the estimated ability of the future available operating force to produce steam effectively.

The difference observed in the cost of the other items may be explained by the difference in the grade of material used and the ability of one purchaser over another to secure the lowest market price.

†Frank Koester, in "Engineering News."

FUEL TESTS IN A PRODUCER GAS POWER PLANT.

The accompanying table shows the results obtained on a wide range of fuels tested by the technologic branch of the U. S. Geological Survey, under the direction of Joseph A. Holmes, expert in charge, and Robert Heywood Fernald, engineer in charge. These tests were made at St. Louis, Mo., at the fuel-testing plant which was located on the grounds of the Louisiana Purchase Exposition.

At the time this plant was erected there were but few gas-producer plants in the country burning any class of bituminous coals and many prominent engineers were in doubt as to the possibility of operating a gas engine on gas produced from coals such as are mined in the central and western States.

This branch has done a valuable service to the country in demonstrating the possibility of burning nearly all classes of low-grade fuels with good economy. As will be noted in the table, the poorer coals required a correspondingly greater quantity of the fuel to produce a horsepower.

Table of Data and Results on Representative Fuels Burned in a Producer Gas Plant at the Fuel-Testing Plant of the Technologic Branch, U. S. Geological Survey.

Fuel	Proximate analysis per cent				B. T. U. per pound of fuel		Cu. ft. standard gas produced per pound of equivalent* fuel consumed by producer plant		B. T. U. per cubic ft. standard gas	Pounds of equivalent* fuel per B. H. P. Hr.	
	Moisture	Volatile matter	Fixed carbon	Ash	As fired	Dry	As fired	Dry		As fired	Dry
Florida Peat	21.00	51.72	22.11	5.17	8,127	10,289	28.5	36.1	175.2	2.57	2.03
Average of four lignites	35.05	28.96	27.72	8.27	7,164	11,038	26.3	40.3	169.9	2.43	1.73
Average of four Illinois coals	11.51	31.81	43.46	13.22	10,651	12,030	49.6	56.1	153.2	1.66	1.47
Average of four Pennsylvania coals . . .	3.47	19.68	67.31	9.54	13,651	14,136	71.4	74.0	141.6	1.16	1.12
Average of four W. Virginia coals	2.47	32.12	60.24	5.17	14,248	14,610	77.5	79.5	149.6	1.03	1.00

The equipment used was a 250-horsepower pressure producer with a centrifugal tar extractor and gas-holder. A 235-horsepower three-cylinder vertical gas engine belted to a generator produced power which was measured by electric instruments connected with the switchboard. As will be seen, the results obtained are much better than those from steam plants of corresponding size.

Of the four Pennsylvania coals tested, two came from the lower Kittanning bed, one from the lower Freeport, and the fourth from the Pittsburg bed.

Of the West Virginia coals, one came from the Ansted bed, another from the Eagle, both of these being mined in the New River district, a third from the Pittsburg, and the fourth from the Keytsone bed.

*Equivalent fuel includes that used in the producer, and also the amount required to generate the steam necessary for operating the producer.

Spokane, Wash.—In extensions and improvements the Washington Water Power Company plans to expend this year $1,000,000. Most of this money will go into bettering the service, buying new cars and putting its conduits under ground, while a big sum will go toward the extension of its power lines. A line is now under construction from Medical Lake to Lind, Wash., while extensions are projected in the Coeur d'Alenes and in the Palouse country.

WATER POWER AS AN ECONOMIC FACTOR.

By Harrison Williams.

The cost of steam power for operating the New England cotton mills has been estimated at $36 per horsepower-year; and I may add that it can be produced at that figure only in large units, by use of high-class engines and comparatively cheap fuel. At the above horsepower-year cost, $900 earning four per cent per annum would be required to support one horsepower; or a capitalization of $80,000,000 to support as much power by steam as can be obtained from the Chelan water power.

The actual horsepower-year cost of water power takes a wide range, but, with perhaps rare exceptions, it may be included between the extremes of $5 and $15; though in the case of very large powers and low cost of development, even the smaller figure would make the property a bonanza—if all in use.

The significance of these comparisons will be more adequately realized by the statement that the last federal census report gave the amount of steam power employed in manufacturing in the United States in 1900 at 10,828,111 horsepower, and of water power at 1,642,035 horsepower; eighty-seven per cent of the whole being steam power and thirteen per cent of the whole being water power. Forty-four per cent of the water power was taken by one industry, the wood-pulp and paper industry; the cost of steam power for grinding wood-pulp being practically prohibitive. A recent census bulletin has this statement: "Abundant power is now so important in this industry that availability of water power is a more important factor in determining the location of plants than nearness to the source of supply or to the market."

Bear in mind, these statistics relate only to power used in manufacturing, and that heretofore transportation has been accomplished almost wholly by means of steam power—as it must continue to be in most situations.

As the purpose of this article is, in part, to demonstrate the pre-eminence of the section comprised in the northeastern portion of Washington, the panhandle of Idaho and extreme northwestern Montana as regards supply of water power, I quote the following from an article in the February, 1906, "Review of Reviews," by Richard H. Edmunds:

"The utilization of water power for electrical purposes promises to make this section the center of activity in that line in America. Already water power aggregating half a million or more horsepower is being harnessed for electrical work in the central South. Pittsburg capitalists are spending over $6,000,000 to generate 75,000 horsepower in the Yadkin River, North Carolina, for electrical transmission to factories to be established there, as well as to neighboring towns. On the same river two other undertakings which will aggregate about the same power and the same investment, are being financed. Near Chattanooga several million dollars are being expended in the utilization of a great power in the Tennessee

River for the transmission of 60,000 horsepower to that city. At Knoxville a plan is under way and likely to be soon actively in operation, involving an outlay of $2,500,000. New York and Southern capitalists are developing under one management several powers which will total over 100,000 horsepower, costing $7,000,000 to $8,000,000, to be tributary to Charlotte and neighboring towns, and about 100,000 horsepower is being developed in the vicinity of Atlanta."

As between the Atlantic Southeast and the Pacific Northwest I think the reader will have no difficulty in settling the question of pre-eminence after examining the following table, compiled from a large mass of government reports on stream measurements:

Stream Measurements.
From U. S. Water Supply Papers.

Name of Stream—	Year	Second Feet Max. July	Min. Oct.	Mean 6 Mos.	Ratio of Max. to Min.
Pend d'Oreidle at Priest River, Idaho	1903	113,700	14,230	27,785	8 to 1
Pend d'Oreidle at Priest River, Idaho	1904	June 93,000	Dec. 7,830	28,130	12 to 1
Pend d'Oreille at Priest River, Idaho	1904	July 86,700	Dec. 7,830	6 Mos. 18,157	9 to 1
Hudson at Mechanicville, N. Y.	1903	36,283	705	9,160	80 to 1
Hudson at Ft. Edwards, N. Y.	1903	35,780	360	5,687	99 to 1
James at Buchanan, Va.	1903	31,050	410	3,090	76 to 1
James at Cartersville, Va.	1904	35,700	755	4,575	47 to 1
Yadkin at Salisbury, N. C.	1903	76,200	1,500	6,850	51 to 1
Yadkin at Salisbury, N. C.	1904	19,320	1,050	2,873	18 to 1
Flint at Woodbury, Ga.	1903	25,750	290	1,888	89 to 1
Tennessee at Knoxville, Tenn.	1903	124,070	2,180	14,527	57 to 1
Androscoggin at Rumford Falls, Me.	1902	18,468	1,580	4,396	12 to 1
Merrimac at Garvins Falls, N. H.	1905	32,760	1,090	3,840	30 to 1
Potomac at Point of Rocks, Md.	1902	218,700	1,296	14,500	168 to 1
Potomac at Point of Rocks, Md.	1903	99,590	2,000	12,480	50 to 1
Potomac at Point of Rocks, Md.	1904	38,500	900	6,330	43 to 1
Chattahoochee at West Point, Ga.	1904	29,340	800	3,016	37 to 1
Chattahoochee at West Point, Ga.	1905	32,340	1,090	4,365	30 to 1
Susquehanna at Williamsport, Pa.	1904	135,100	830	9,450	163 to 1
Catawba at Rockhill, S. C.	1902	79,400	2,700	5,112	29 to 1
Catawba at Catawba, S. C.	1904	24,850	810	3,545	31 to 1
Grand at Grand Rapids, Mich.	1905	49,340	1,753	5,050	28 to 1
St. Joseph at Buchanan, Mich.	1904	6,545	1,436	3,400	4.6 to 1
Missouri at Townsend, Mont.	1901	22,880	1,020	5,961	22 to 1
Colorado at Yuma, Arizona	1902	59,200	3,050	10,970	19 to 1
Colorado at Yuma, Arizona	1904	51,170	3,342	13,922	15 to 1
Mississippi at Anoka, Minn., May 8, July 21, Aug. 1 (freshet period)	1905	14,950	27,150	15,570	to 1
Chelan at Chelan Falls, Wash.	1904	8,835	500	2,722	17 to 1
Chelan at Chelan Falls, Wash.	1905	9,200	776	2,503	12 to 1
Wenatchee at Wenatchee, Wash.	1905	8.780	550	2,735	16 to 1

In the absence of retaining reservoirs like Lake Chelan, only about one-third, on an average, of the stream's discharge is available for power, somewhat more where the ratio between the maximum and minimum is low, and a good deal less where it is very high. It will be seen by reference to the table that in one case in the Southeast as much water runs off in one day as would run off in 168 days at the lowest stage. In the case of the streams having exceptionally high ratio—a feature characteristic of the streams of the "Piedmont" region of the Southeast—for several months in the year the second column would be a truer index in the matter of power than the third column. The fact is, those powers have been greatly over-rated in the above excerpt, but accepting the claim made therein the Pend d'Oreille alone has as much available power as the whole group. We have in that stream only a very simple problem in arithmetic to solve, from definite data. One cubic foot of water per second under eleven feet of head, giving eighty per cent of the theoretical as useful effect, produces one horsepower. The Pend d'Oreille is a low ratio stream, and besides, has three lakes, two of them of considerable magnitude, in which water may be held back, so, of the 28,130 second feet discharge 10,000 may be safely reckoned on for power all the time—and as much more a good deal of the time as it may be an object to install plants for. Of the 750 feet fall between Lake Pend d'Oreille and the Columbia, 550 feet at the least may be utilized, giving the enormous amount of 500,000 horsepower; this being only twenty-six per cent of what the figures would become by the utilization of all the water—28,130 second feet—and all the fall—750 feet.

By use of the waters of the Kootenai, Clark's Fork, the Columbia at Kettle Falls, the Spokane, not to mention the Chelan, several hundred thousand horsepower can be added to the above.

The Chelan water power makes a comparatively small showing in the above table, whereas it is in fact one of the largest unit water powers—that is, admitting of all being utilized in one installation—in the whole country. Lake Chelan, which presents a striking object lesson on the importance of reservoirs, can be given capacity sufficient to permit of the water all being drawn through the wheels of the power plant, either at a uniform rate or as occasion may require—the power having direct connection with the reservoir—so that the entire potential capacity of the Chelan River may be realized; the single instance in the case of a large water power in the United States. Lake Chelan also presents an object lesson in connection with a piece of history which I need not relate here, on the subject of government control of reservoirs, in accordance with the president's recent suggestion; so that they shall not be tampered with in order to serve private or merely local interests.

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EDITORIAL.

SINGLE-PHASE TRACTION.

The paper and discussion on the operation of the single-phase equipment of the San Francisco, Vallejo and Napa Valley Railroad, published in this issue, presents an interesting account which will prove of practical value to all operating, or contemplating the installation of such a system. A committee of five members of the San Francisco section of the American Institute of Electrical Engineers were given full access to all the records of this company, and also made a series of tests themselves. It is the pioneer western installation, having been in operation almost three years. In fact, there are but two other single-phase railroads in America that have been running longer than this, and they by only a few months. Today there are about thirty single-phase roads, with a total length of nearly one thousand miles. This development has followed the advent of the commutator type-alternating current motor, four years ago. Such motors may be either of compensated repulsion or compensated series, the former having been greatly perfected by Mr. Lamme. For traction work it depends for speed regulation upon the change in the transforming ratio.

Originally operated at a trolley voltage of 750, the system was soon changed to 3,300 volts. The control was modified from induction regulation to unit switch method. The trolley construction was changed from standard 500 volts to catenary, and a pantograph trolley was substituted for wheel and pole.

The single-phase motor for traction purposes is fast passing beyond the experimental stage, and has already demonstrated its economy in competition with direct current installations whose conversion losses are necessarily high. The design of electrical machinery is being so rapidly improved, that one system is no sooner in successful operation than it is superseded by another even better, and the men who have the courage to adopt untried apparatus are earning the well merited gratitude of those who follow.

THE ELECTRIC CLUB.

The electrical men of the Coast are being invited to join in the organization of a club. This project was ready to be launched just two years ago, but the disrupting effects of the disaster of that time have delayed its perfection until now. Personal needs and widely scattered business interests have so occupied the attention of possible members that the advantages of social organization have been neglected.

The proposed club offers a convenient center for congenial clans already organized, and also a rendezvous for those unattached. The former include the Electrical Trades Association, the Electrical Contractors Association, the local members of the American Institute of Electrical Engineers, and the Sons of Jove. Each of these organizations have frequent meetings and dinners, whose expense might be reduced and whose attractiveness increased if held under the auspices, or, at least, in the quarters of such a club. It would in no way supersede or assume their functions; on the contrary, it would help them by promoting comfort and sociability.

As a nucleus, the club will rent and furnish a handsome room in a central building, offering every convenience of a first-class grill and hotel. There electrical men can foregather and amicably meet one another on a common basis. Visitors may be put up for a meal or a month where they can meet those they wish. Later an assembly hall will be provided, and regular meetings to hear practical papers on electrical matters are proposed.

To carry through these plans there is necessary the co-operation of every electrical man in the vicinity. Fixed charges will be reduced to a minimum, but these must be regularly met. So the committee is soliciting a membership large enough to guarantee financial as well as social success.

Representation without taxation is no more logical than was its antithesis as shown at the Boston Tea Party; but the dues are low enough to be within the means of all, and further, the greater the membership the lower the individual tax. It seems strange that a large and important industry on the Pacific Coast should have so little coherence among those engaged in it, especially when we consider their various and desirable talents. So be ready when the committee calls upon you.

PUBLICATIONS RECEIVED.

"Steam Electric Power Plants," by Frank Koester, is a 450-page practical treatise on the design of central light and power stations, and their economical construction and operation. It includes a general discussion of every phase of steam-electric power plant construction, giving details by pictorial rather than textual means. There are 268 half-tone illustrations and sectional drawings of power plants all over the world. The author's treatment of the subject is in conjunction with the cost of construction, installation, operation and maintenance. The arrangement is logical and essentially practical in its successive presentations of the problems that a designer must consider. In the design of the building he urges that more attention be paid to the architectural work, saying: "A pleasing appearance can always be secured without any additional expense." Boilers and all auxiliary apparatus are treated in a general but thorough manner, with particular stress on piping, as this is the most important feature after the general lay-out has been completed. This chapter is accompanied by several illustrations of typical installations of piping, supports, and tables of sizes. A short comparison of engines and turbines is followed by a more detailed classification of each kind of prime-mover. The discussion of electrical equipment is limited, being primarily intended for the information of the mechanical engineer. A chapter is devoted to the design of small power plants, and another to power-plant testing. The volume is closed with descriptions of typical American and European light and power plants. In this admirable collection it is to be regretted that the author makes no mention of oil as fuel, with its accompanying storage tanks, receivers, pumps, atomizers, etc. The material has already appeared in many of the technical periodicals, but this book classifies and brings into convenient form the results of an expert examination of many plants. It is published by D. Van Nostrand Co., of New York, for $5.00.

ELECTRICAL TRADES ASSOCIATION.

The sixth annual meeting of the Electrical Trades Association was held at Solari's Grill, Friday, April 10th, 1908. This was the largest meeting of the Association ever held, there being twenty-three electrical houses represented, and thirty-two present at the table. Following out the regular custom, a luncheon was served, and the business of the meeting was transacted after the luncheon.

The Electrical Trades Association is a credit association, formed amongst the electrical jobbers and others engaged in the electrical business. This association is a branch of the National Association, and organized May 19th, 1902, with fourteen members. There are now thirty-four members, spread pretty well over the Pacific Coast States.

The annual reports of the president, Samuel H. Taylor, and of the secretary, were read. The officers elected for the ensuing year are: Samuel H. Taylor, president; R. W. Valkenburgh, vice-president; Harry Sayles, J. A. Vandegrift, and A. E. Drendell, of the executive committee.

After the regular business of the Association was transacted Mr. T. E. Bibbins, of the General Electric Company, was requested to address the meeting, on the subject of "The Sons of Jove." He urged all engaged in electrical business to join the order.

Mr. Scribner was also requested to address the meeting, on the subject of "The Formation of an Electrical Club." He told, in a very interesting way, of the plan for organizing a Social Club composed of men engaged in electrical business and kindred lines. After two hours' session the meeting adjourned, and it was voted by all present as having been the most successful meeting of the Electrical Trades Association ever held.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

Mr. H. J. Gille, of the Minneapolis General Electric Company, will come before the N. E. L. A. Convention this year at Chicago, as editor of a paper on the "Preparation of a Campaign." This paper has been divided into five sub-titles, and will consider (a) Field Work and Other Essentials; (b) Analysis of Customer's Accounts; (c) Proportion of Lamp Equivalent Lost to Lamps Connected—Showing Percentage in Cities of Varied Population; (d) Policy of Handling Complaints; (e) Policy of Handling Collections. Mr. Lewis A. Furguson, of the Commonwealth Edison Company, of Chicago, will edit a paper on the "Relation Between the Engineering and Commercial Department."

JOVIAN REJUVENATION.

A rejuvenation of the Sons of Jove was held at Solari's, in San Francisco, on April 10th, with about forty Jovians present. The following were initiated:

H. D. Boschken, Charles O'Donald Blanchfield, Lyman Roscoe Boynton, Wallace Wheaton Briggs, Robert James Davis, Cass Lord Gilson, William Wallace Hanscom, Arthur Hobart Halloran, William Stultz Hanbridge, George Alfred Hearn, Benjamin Christian Holst, Edwin Ames Hunt, George Irving Kinney, Frederick Valentine Meyers, Roscoe G. Rice, John G. Sutton, Ernest M. Schlessinger, Robert Waldo Van Valkenberg, and Russell Lewis Waldenburg.

After the ceremony a sumptuous banquet was spread, concluding with speech-making and music from the Jovian Choir.

PERSONAL.

James M. B. Irwin, Los Angeles representative of the Electric Appliance Co., was in San Francisco last week.

John M. Klein, of Mathias Klein & Sons, of Chicago, visited San Francisco recently, on a hurried trip.

C. W. Koiner has resigned as general superintendent and engineer of the Los Angeles Gas & Electric Co., to become general manager and engineer of the municipal lighting plant at Pasadena, California.

E. E. Potter has succeeded H. F. Grant, resigned, as general manager of the Seattle Electric Co. Mr. Grant continues his duties as Pacific Northwest district manager for Stone & Webster.

Melville Dozier, Jr., has been appointed assistant general manager of the Northern Electric Railway at Chico, Cal. Mr. Dozier formerly was president of the Vallejo & Northern Railway Company, which is building an electric line from Sacramento to Vallejo, Cal.

E. E. Keller, for over twenty years connected with the Westinghouse interests, and for 14 years vice-president of The Westinghouse Machine Co., having completed his duties as receiver and general manager, severed his connection with the management of that company on the first of this month. Mr. Keller will take a much-needed rest, and will then devote most of his time to several personal interests.

TRADE CATALOGUES.

The Electric Appliance Co., 726 Mission Street, San Francisco, sends leaflets on the Benjamin "Arc Burst" and the Perkins "2000" switch.

REMOVAL NOTE.

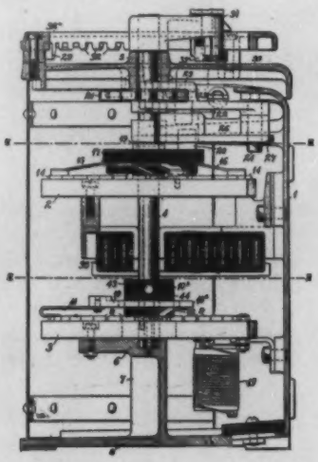
The Brookfield Glass Co. announce the removal of their general offices to the U. S. Express Bldg., Trinity Place, Greenwich and Rector Streets, New York City.

The San Francisco office of the Allis-Chalmers Company has been moved from 604 Mission to the south east corner of Second and Mission streets where they are now permanently located.

PATENTS

CONTROLLER FOR ELECTRIC MOTORS. 883,200. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company.

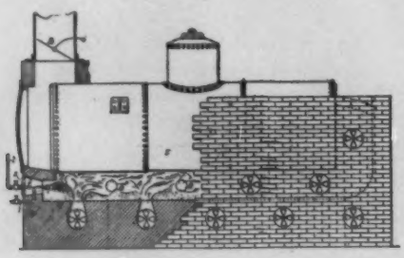
In a controller for electric motors, the combination with an annular set of stationary contact terminals, a pair of rigidly connected but electrically independent contact arms to engage said contact terminals, a second set of stationary contact



terminals similarly disposed in a plane parallel to that of the first set, and a single movable contact arm therefor, of a rotatable shaft for said movable contact arms, and means for temporarily disconnecting pair of contact arms from shaft after the shaft has been rotated through a predetermined angle in either direction from the "off" position of the controller.

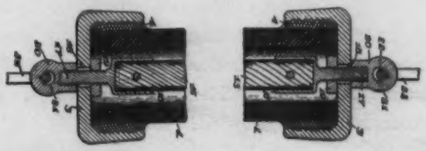
FLUID-FUEL FURNACE. 883,260. Edward C. Voorheis, Sutter Creek, Cal.

In a fluid fuel furnace for the purpose set forth, the combination of a combustion chamber formed to constitute a continuous, completely free passage for the gaseous fuel therethrough, a fuel feeding device to introduce fluid fuel at one end of the combustion chamber of the furnace consisting of a controllable conduit for liquid fuel and a controllable conduit for gaseous fluid under pressure, the exhausts of both of



said conduits being adjacent, whereby the liquid is atomized, and a damper to regulate the flow of the inflaming gases through the combustion chamber, the bottom wall and side walls of the furnace being each provided with a series of valve controlled air inlet passages arranged at regular intervals whereby a regular and progressive combustion of fluid fuel throughout the entire combustion chamber is effected, combustion being initiated and sustained only at predetermined points along the combustion chamber.

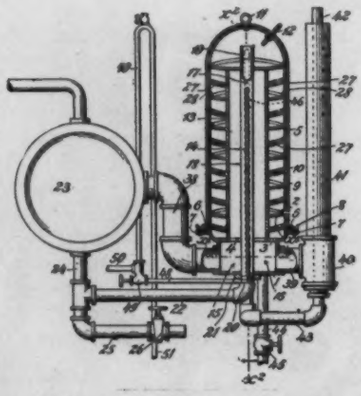
INSULATOR. 883,397. Walter T. Goddard and John S. Lapp, Victor, N. Y., assignors to The Locke Insulator Manufacturing Company, Victor, N. Y.



In an insulator, attaching devices, and a pair of tension elements made of insulating material connecting the attaching devices and having different tensile strength.

OIL-GASIFIER. 883,472. William H. Neher, Inglewood, Cal.

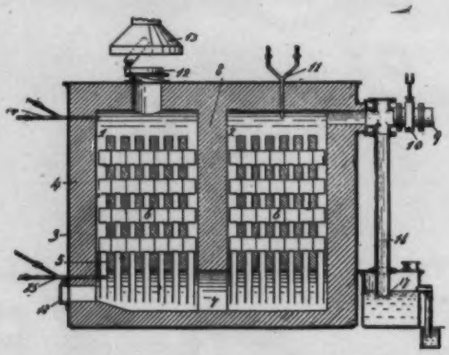
A base, a vaporizing member above the base, a dome housing and nesting with the vaporizing member, flanges on the vaporizing member extending to the wall of the dome



and forming a series of chambers, the flanges having openings whereby a tortuous passage is formed, means for conveying fuel to the flanges, means for conducting heated air through the tortuous passage, and means for conveying gas from the interior of the dome.

PROCESS OF MAKING GAS AND COKE. 883,466. Leon P. Lowe, San Francisco, Cal.

The process of making gas and coke which consists in simultaneously highly heating two segregated bodies of loosely piled refractory material and a retort chamber, discontinuing the step of heating, passing steam into contact with one body of refractory material to superheat the steam,



passing oil directly into the retort chamber to distil the oil, retaining the non-volatile components of the oil in chamber in the form of coke, and passing only the steam so superheated and the volatile portion of the oil so distilled together into contact with the second body of refractory material, to make combustible gases.

INDUSTRIAL

HADAWAY ELECTRICALLY HEATED STAMPING PRESSES AND GLUE POTS FOR BOOKBINDERS.

The illustration shows two electrically heated devices that are rapidly gaining favor with bookbinders—the stamping press and the glue pot. The finer sort of work that the binder has to do requires great cleanliness to make it profitable, while edition and pamphlet work require dispatch. These electrical devices fulfill both requirements. They are always ready for service and always maintain a uniform temperature so that no delay need ever be experienced. The cleanliness of electric heat does away with the spoilage of costly binding materials that frequently results from the use of gas or steam, no matter how careful the binder may be.

The glue pot is provided with a patent water circulating device that brings the glue up to the proper temperature in much less time than would be otherwise required, and with a cut-out which reduces the current so that just enough is used to keep the glue at a fixed temperature.

The design of the stamping press head is such that the heater and its insulation is entirely protected from the direct pressure, the head being practically a solid block of iron. This form of construction is very rigid and the head has no tendency to give and reduce the pressure. The heating element is divided into sections, permitting the heat to be localized in the center or in the ends, or to spread over the entire head, as desired.

Both the glue pot and stamping press are manufactured by the Hadaway Electrical Heating and Engineering Company and sold by the Westinghouse Electric and Manufacturing Company.

TRADE CATALOGUES.

Appleton Electric Company, of 224-226 East Washington Street, Chicago, Ill., and 833 Folsom Street, San Francisco, send an illustrated description and price list of Alnilets, a line of conduit fittings.

PUBLICATIONS RECEIVED.

The main paper in the April Proceedings of the American Institute of Electrical Engineers is by Henry Floy, on "The Engineer's Activity in Public Affairs." The balance of this number is made up of notes, comments and discussion.

INSULATORS FOR EXTREMELY HIGH VOLTAGE LINES.

The frame type insulator shown in Figure 1 was designed for lines requiring 150,000 volts, line pressure. It is stated that it will stand a spray test of 280,000 volts, leaving a large factor of safety, and carry a mechancial load of 20,000 pounds. It can be constructed to carry as much more as desired by

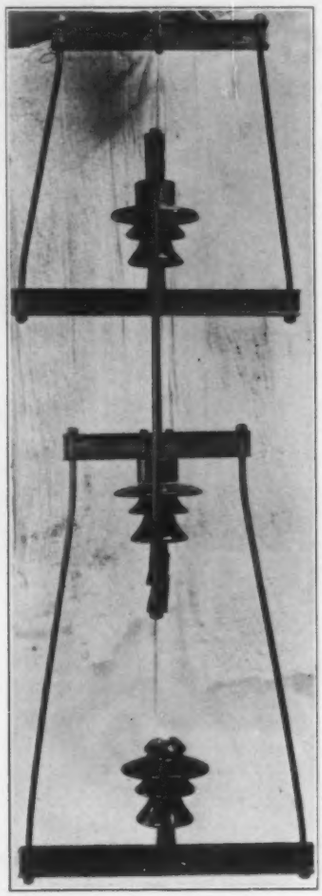


FIG. 1.

increasing the eye beams and side rods and the bearing surface of the porcelain. The frames are interlocked like a chain so that the line will not come down. All the porcelain parts are under compression and are designed to have a surface large enough to carry the required mechanical load with a large factor of safety. Under an electrical test this insulator does not show the usual static stresses and is extremely quiet up to the arcing point which takes place between the frames. In case of an arc from lightning, it will take place between the frames and not injure the insulator. These insulators are furnished in any size for line voltages from 70,000 volts up to 300,000 with a factor of safety of 2 under a spray test, and any mechanical load desired. It is designed for the hanging type, but can be supported at either end and can be used horizontally or perpendicularly. It is manufactured by the Lima Insulator Company, Lima, N. Y., as designed by Mr. F. M. Locke, whose patents are now pending.

Figure 2 illustrates a 450,000-volt, 150-kilowatt transformer used to test the above insulator, and is installed at the Lima Insulator Company's plant. It was made by the Central Laboratory Supply Company, Lafayette, Ind. Figure 3 shows porcelain bushings manufactured by the Lima Insulator Company for Locke 450,000-volt, 150-kilowatt transformer and is insulating successfully the lead wires. These bushings are oil-filled and the holes through the top caps are to support the coke coils at each terminal. They weigh about 200 pounds each.

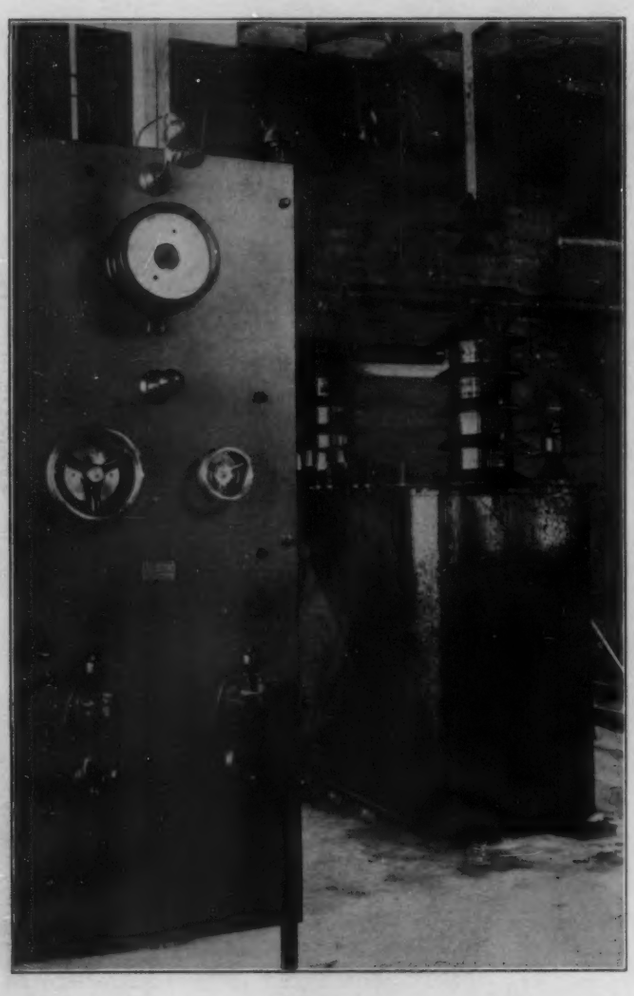


FIG. 2.

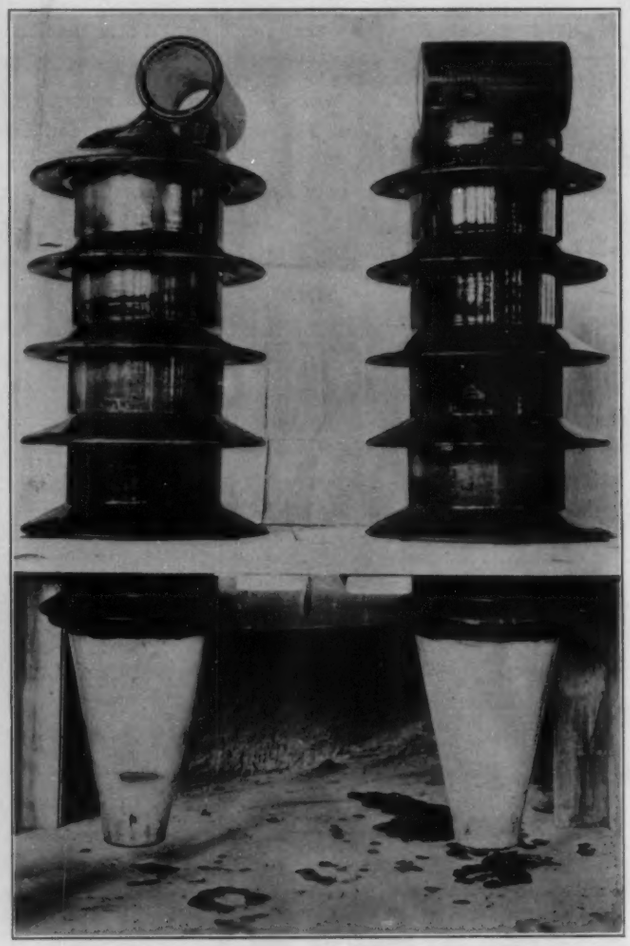


FIG. 3.

CURTIS TURBINE BUSINESS.

A number of interesting facts are revealed in the statement of Curtis Turbine sales which follows:

ORDERS to Dec. 31, '07.	Number of plants Capacity 1000 kw. and less	Capacity above 1000 kw.	Total number of plants	Average Kw. Cap. of plants	Total Kw. capacity
Central Station and Railway Traction.	71	190	261	3,778	986,020
Industrial plants and Miscellaneous.	243	45	288	305	87,675
Totals	314	235	549	1,956	1,073,695

	Number of machines	Average Kw. capacity per machine	Total Kw. capacity
Installations to Dec. 31, 1907	943	857	807,610
Orders on hand Dec. 31, 1907	153	1,739	266,085
Total Sales to Dec. 31, 1907	1,096	980	1,073,695
Orders for fiscal year ending Feb. 1, 1908	325	890	286,320

The most noticeable single item is the total capacity sold to December 31, 1907, 1,073,695 kilowatts, or about 1,556,000 brake horsepower. This is the strongest indication of the advance of the steam turbine generating unit that has ever been published. That this advance is accelerating rapidly is shown by the amount of the sales of Curtis Turbine Generators for the past fiscal year of the General Electric Company, 286,320 kilowatts capacity, or more than 25 per cent of the total sales since the Curtis turbine was introduced.

Another fact of considerable interest is the large number of plants for which the Curtis turbine has been selected as prime mover. The large range of sizes in which this turbine is sold is probably responsible for the great variation in average sizes of plants in which it is used. The large central stations and electric traction enterprises with an average size of 3,778 kilowatts plant capacity strikingly differ from the industrial plant of 305 kilowatts average capacity.

INSPECTION TRIP.

The students in the College of Engineering, University of Colorado, recently inspected various power plants at Denver, Georgetown and Idaho Springs, under the direction of Professors M. S. Ketchum, H. S. Evans, and J. A. Hunter. There were over sixty students from the junior and senior classes in the party.

NEWS NOTES

TRANSMISSION.

Redding, Cal.—The Southern Pacific will begin work at once on its large power plant, twelve miles west of Dorris, on the Klamath River.

Placerville, Cal.—Ambrose Regalia has filed notice of location and appropriation of the waters of Talbet Ravine at a point in Section 13, Township 9 north, range 12 east.

Ukiah.—Current from the Snow Mountain Water & Power Company's plant on Eel River was turned on at Ukiah for the first time last week. The power line will be extended to Santa Rosa in a few months, and contracts for the work are already being let.

Red Bluff, Cal.—J. W. Roper and L. A. McIntoch have filed a notice of appropriation of 5,000 inches of water in Bee Gum Creek. The creek is to be dammed where the water is to taken out, and the water conducted by pipes and ditches to a power site. The power is to be used in generating electricity.

Sparks, Nev.—The directors of the Selby Consolidated Mining Company have closed a deal with the Truckee River General Electric Company for power and for the installation of electric machinery for the operation of a 60-ton Kinkead mill to be installed at the camp of Jumbo, about 22 miles south of Sparks.

Ogden, Utah.—As a preliminary to the erection of a municipal power plant and the installation of a municipal water system, A. E. Parker, city engineer, acting under the direction of Mayor Brewer and the City Council, filed two applications with the State engineers last week in South Fork Canyon, a tributary stream to Ogden River.

Sacramento, Cal.—At the last meeting of the Board of Supervisors, through A. M. Seymour, as attorney, and C. L. Waller, as agent, the Great Western Power Company made application for a franchise to construct electrical lines throughout the county, including the river islands, for wires to run along, over and below the county roads. The company proposes to extend its lines to San Francisco.

Marysville.—The Great Western Power Company has secured permission from the Levee Commissioners and the City Council to install a derrick and clam-shell bucket at the foot of C Street for the purpose of loading sand from the Yuba River into the Western Pacific cars, the sand to be transferred over the Western Pacific tracks to the site of the big power plant, in course of construction above Oroville.

San Francisco.—D. G. Scofield, Vice-President of the Standard Oil Company, has given out the following statement: "There is no truth in the statement that the Standard Oil Company is concerned in a deal by which all the gas, electric light and power companies in Northern California will be controlled by the Standard Oil interests. Similar statements have been made before, and they were denied authoritatively and positively. The Standard Oil is not concerned in any way in a deal for the purchase of the Pacific Gas and Electric Corporation.

ILLUMINATION.

Rawhide, Nev.—The Rawhide Light & Power Company has been granted a franchise for supplying the town of Rawhide with electric power and light for general purposes.

Los Angeles, Cal.—At the special meeting of the City Trustees, last week, the bid of Robert Weiss of $50 for a franchise for a gas plant for Upland was the only one received, and was accepted.

Rawhide, Nev.—A consignment of poles for the Rawhide Light & Power Company has arrived, and two 80-horsepower engines are now en route here. The work of erecting the power house for their housing is to be started soon.

Pacific Grove, Cal.—A company has been formed to supply gas for this city. It will be under the name of the Pacific Grove Heat, Light & Power Company, under which title H. S. Hales, S. J. Evans and Will S. Smith, of Los Angeles, have filed articles of incorporation. Offices will be both in Los Angeles and Pacific Grove.

Pasadena, Cal.—Unless the Pacific Electric Company repairs its right of way on Fair Oaks Avenue, West Colorado Street, and Salt Lake Avenue, where changes have been made in the tracks, within forty days after passing the ordinance which was placed on the first reading last week, the City Council states its intention of declaring the company's rights to operate cars on those streets under its franchise no longer in effect.

Alameda, Cal.—The Electricity Commission of Alameda is in financial difficulty. At a special meeting Mayor Taylor, Deputy Auditor Croll, and members of the City Council endeavored to straighten out affairs, in order that the Commission can proceed with the new fireproof building, for which $50,000 was voted at a recent bond election. The Commission borrowed heavily from the general fund of the city before getting the bond money. Then it arranged to pay thousands of dollars' worth of bills for new machinery, and between paying these bills and paying back what it owes to the general fund, the Commission has not sufficient money to pay for the new building. The charter requires that before such a contract can be let and work started, all of the money required to pay for the undertaking must be in the city treasury and apportioned to the proper fund.

San Francisco.—At the last meeting of the Public Utilities Committee the matter of the city receiving pay for the privilege of operating cars by overhead trolley on the outer Market Street tracks from Sutter Street to the Ferry Building was talked over, but President Boeckman, of the Sutter Street Company, and Thornwell Mullally, of the United Railroads, refused to make any offer. Mr. Boeckman said his company had expended $15,000 in paving between the tracks in question, and Mr. Mullally stated that the company had expended about $10,000,000 in constructing its lines, paid about one-twentieth of all the taxes received by the city, and did not feel called upon to offer any sum for the privilege. The company's temporary permit does not expire until April 10th, and the committee took the matter under advisement.

TRANSPORTATION.

Santa Cruz, Cal.—The Trustees of the Water and Light Committee were authorized to extend a two-inch water main on Monroe Street.

San Francisco, Cal.—The United Railroads will be permitted to operate on the double tracks in Market Street, from Sansome to the Ferry landing, until June 1st.

Prosser, Wash.—A preliminary survey will begin at once by the Prosser Traction Company of a line from this place south to the Columbia River and to Bickleton.

Spokane, Wash.—A traction road, seventy-seven miles in length, will be constructed from Priest Rapids to the Northern Pacific at North Yakima, tapping the lands now being put under water by the Hanford Irrigation Company.

Chehalis, Wash.—An ordinance has been introduced in the City Council to grant to Eugene A. Marsh the right to construct a street railway, and also an ordinance to grant the same party the use of the streets for telephone and telegraph purposes.

Eugene, Ore.—Work on the Eugene-Springfield electric line has been started just beyond Fairmount, and will not cease until the line is completed to Springfield. The cars will cross the track as soon as the connection is made, and service given to the end of the line.

Portland, Ore.—The surplus earnings of the Portland Railway, Light & Power Company during the coming year will be turned back into the improvement of the street railway lines and the electric light and power service. Not only that, but from $500,000 to $1,000,000 additional will be expended by the company on permanent betterments and extensions this year.

San Diego.—The City Council has passed a resolution awarding the San Diego Electric Railroad Company a street railway franchise to construct and operate for a period of 25 years a street railway commencing at the center of the intersection of Washington Street with Hawk Street, thence running north on Hawk Street to the center of the intersection of Hawk with Lewis Street, and thence running west to the intersection of Lewis Street with Ibis Street.

Chicago, Ill.—At the meeting of the transcontinental lines, held in Chicago in March, 1907, it was arranged to publish in connection with oil rates westbound the oil mixture as provided by the western classification. This change was intended for the new transcontinental tariff, but because of the delay in publishing this, tariff carriers have been requested to make immediate publication in supplement. The eastbound oil rate will also be made to carry the same mixture.

Nevada City, Cal.—D. E. Morgan, president of the Nevada County Oil Company, and Sherman W. Marsh, one of the directors and a heavy holder of the company's stock, have returned from Bakersfield, where they made a thorough inspection of the wells that are being operated by the company. The company now has eleven wells producing. From these eleven wells they are turning out a gross output of about 13,000 barrels of oil a month. On April 1st another well was started.

Yuba City, Cal.—One of the latest railroad propositions in Sutter County, is that of a belt-line railroad to be run so as to take in the section of the county lying south and west of Yuba City. The scheme is one being talked up by a few prominent Marysville business men, W. H. Parks being one of the prime movers. This scheme, it is understood, has no connection with the present Northern Electric system, but is one promoted purely for local purposes.

Ashland, Ore.—Capt. F. L. Evans, manager of the Oregon Rapid Transit Co., a company recently organized under the laws of Arizona Territory, appeared before the Ashland Commercial Club in behalf of a project for the building of an electric railroad line through the Rogue River Valley, starting at Ashland and extending to Grants Pass, a distance of forty miles. The club will take some action in the matter.

San Francisco, Cal.—The Lagunitas Water Company, of Marin County, has decided to incur a bonded indebtedness of $2,000,000 for the construction of a water works plant and distributing system. This means the development of the large water-shed of the Berry ranch, on the northern slope of Mt. Tamalpais. When the plant is in operation it will furnish to the people of the southern part of Marin County, it is estimated, between eight and twelve million gallons of water daily.

TELEPHONE AND TELEGRAPH.

Salt Lake City, Utah.—The Rocky Mountain Bell Telephone Company has in contemplation the erection of a line from Miles City, Mont., to Billings, Mont. This line will involve the stretching of about 350 miles of wire.

San Jose, Cal.—S. J. Lisberger, engineer of electrical distribution for the California Gas & Electric Company, was in San Jose recently, examining the section of the city in which all the wires are to be laid underground.

The Department of Electricity has presented its estimates for next year's budget to the Board of Supervisors. Chief Hewitt asked for a total of $275,450.06. This sum is divided as follows: Salaries, $63,900; maintenance, $17,690; rehabilitation, $70,588.10; restoration of police signal system, $19,867.40; restoration of the overhead fire and police alarm systems, $9,844.56; underground, $93,700.

Bakersfield, Cal.—The Kern Mutual Telephone Company, which has for its object the connection of the west side oil fields with Bakersfield and long-distance phones of the Pacific Coast, has been organized, with a capital of $35,000. The officers are F. G. Munzer, president; Tim Spellacy, vice-president; Harry W. Thomas, secretary; James McGuire, treasurer; R. E. Galloway, general manager. The building of the new line will be begun immediately, and Mr. Galloway has left for McKittrick, to spend several days in preliminary arrangements. The long-distance loop will be of copper, enabling subscribers to talk to any place where there is a long-distance phone. The line will be independent. It will be 150 miles long, the main trunk lines being seventy-five miles in length. The line will place McKittrick, Midway, Sunset, and Maricopa in direct communication with Bakersfield.

TELEPHONES.

Redding, Cal.—The Northern California Power Co. are installing a private system of sixty telephones for their own use.

Steptoe, Wash.—Mayor Trowbridge has succeeded in getting plans perfected to have the Rosalia telephone line extended to Steptoe.

Tacoma, Wash.—The Inland Empire Telephone Co. will extend their system from Gig Harbor to Vashon Island, by submarine cable.

Oregon City, Ore.—The Mount Scott Telephone Company has organized for the construction of a line from Lents to Happy Hollow, over Mount Scott.

Vallejo.—The gunboat Yorktown arrived at the Mare Island yard last week. While at the yard a wireless system will be installed and some repairs will be made.

Yerington, Nev.—H. Hironymous and J. I. Wilson have formed a company for the purpose of building a telephone line connecting Yerington with Mountain View.

Cashmere, Wash.—It is reported that Colonel Huston is contemplating another telephone system for Cashmere, to compete with the Farmers' Telephone Company.

Ephrata, Wash.—The Commercial Club has appointed a committee to look into the feasibility of a telephone line to extend from High Hill through Soap Lake to this place.

Salem, Ore.—The Monitor Mutual Telephone Company has petitioned the County Court for a franchise for a telephone line from Monitor to Woodburn, McKee and Mt. Angel.

Medford, Ore.—The Pacific Telephone & Telegraph Co. have offered to sell their plant at this place to a local company for $8,000. There are 400 subscribers connected and a large number of prospective subscribers are waiting for telephones to be installed.

Wardner, Ida.—The Interstate Telephone Company will be in shape to open up its long-distance lines to Wardner, Kellogg and Wallace, by May 1. The line is now completed to a point between Kingston and Wardner.

Edmonds, Wash.—Mr. De Varney, of the B.-R. Electric Co., of Portland, has just finished the installation of a small common-battery telephone plant here, for the Edmonds Independent Telephone Co., and the system is now being placed in service and subscribers connected up.

San Francisco.—Sausalito, Mill Valley and San Rafael have been added to the list of cities on the other side of San Francisco Bay which receive telephone service by the two-number system of long distance communication. The Marin County exchanges were cut over to the new service this week.

Bellingham, Wash.—The Sunset Telephone Company will begin at once the installation of common batteries in all its Bellingham telephones, to replace the local batteries. From fifteen to twenty-five men will be employed. Manager B. F. Reno says that the work is great enough to keep twenty-five men busy about three months. The cost of labor and material will be $6,000 or $7,000.

Gooding, Ida.—Furcht & Furcht are erecting an office building on Main Street, which they will occupy as a real estate office, and will also use it as general offices for their telephone company, which has a franchise for erecting an independent line in the streets and alleys of all unincorporated towns and villages of the county, as well as the use of all the public roads of Lincoln County.

Chehalis, Wash.—R. S. Reany, who for several years past has had charge of the local telephone system of the Pacific States Company, announces that extensive improvements will be made. Mr. Reany will purchase the telephone systems in operation in Chehalis and Centralia, and will organize a company to control them. It is his intention to put in a complete and modern system in both cities.

Vancouver, B. C.—The British Columbia Telephone Company secured a recommendation that the following pole lines be constructed: Seaton Street from Burrard to Butte, Dufferin Street, Sixth Avenue, Seventh Avenue, Eighth Avenue, lane between Ninth and Tenth Avenues, lane between Tenth and Eleventh Avenues, Twelfth Avenue and Sophia Street, lane between Granville and Seymour Streets, lane between Granville and Howe Streets, lane between Howe and Hornby Streets, lane between Hornby and Burrard Streets, Hamilton Street, the lanes between Burnaby and Davie, Homer Street, underground conduits in streets, and Davie and Pendrill Streets.

WATERWORKS.

Vallejo, Cal.—Bids for the construction of the pipe line showed that J. F. Gore made the lowest tender, but his bond was a few cents shy. C. D. Vincent, the next lowest bidder, was awarded the contract for $3,874.00.

Salt Lake City, Utah.—S. M. Levy, engineer for the National Development Company, and manager of the operations of the Snyder-Loose-Wingfield syndicate in the Gold Circle district, arrived from camp last week, to purchase pipe for a water system for the town of Midas.

Oakland, Cal.—The compromise between the People's Water Company and the city, binds the water company to install a much larger system of mains in Linda Vista, in East Oakland heights and in upper Broadway, and to complete a larger storage reservoir in East Oakland.

Oakland, Cal.—The contract for installing and furnishing the pumping machinery of Oakland's salt-water system of fire protection, has been awarded to the Doak Gas Engine Company by the Board of Works. The machinery will cost a little over $25,000. The matter of providing plans for the buildings and foundation of the municipal salt-water plant, was left to John Gaylord Howard and partner, John Galloway. They will commence the work of drawing the plans at once. Eastern firms were also bidders for the pumping machinery.

San Francisco, Cal.—While the members of the Board of Supervisors and the officials of the Spring Valley Water Company were struggling to reach an agreement as to the future supply for San Francisco, City Engineer Marsden Manson, acting as the special commissioner of the municipality, was hurrying to Washington on a secret mission to secure the rights to the Hetch-Hetchy system. Every effort was made to keep Manson's departure a secret. He was granted a leave of absence quietly, and left last Tuesday morning, vested with full authority to act for the city in the negotiations in Washington.

FINANCIAL.

Bakersfield.—An assessment of 1 cent per share, delinquent May 5th, sale day May 23d, has been made on the U. S. Oil and Mining Company's stock.

San Francisco.—Assessment No. 2, of 5 cents per share, delinquent May 4th, sale day May 23d, has been levied on the stock of the Monte Cristo Oil & Development Company.

New York.—The United Railways Investment Company's $3,500,000 notes are all subscribed for. The March gross earnings of the United Railroads of San Francisco are $558,524, an increase of nearly 4 per cent over last year.

Los Angeles.—A recent meeting of the City Council authorized another issue of $240,000 aqueduct bonds of denominations of $200. This issue is designed for popular subscription and is expected to appeal to many persons who have small amounts of cash to invest safely. The bonds will bear 4 per cent interest.

San Francisco.—The Spring Valley Water Company has submitted two propositions to the representatives of the municipality—one that the city buy its entire system, except the Lake Merced property, for $28,000,000; the other that the city grant such a material increase of revenue to the company that the latter may continue in business and be able to make such needed improvements as will put off for a time, at least, the danger of a water famine. The increased revenue is to be provided, according to the suggestion of the company, by allowing the 1902 rates to private consumers to be raised by 15 per cent, by making the charge to the city for hydrants $5 each, and by allowing the company something for depreciation, the sum of $200,000 being tentatively suggested.

The annual report of the Northern California Power Company, submitted to the stockholders by President H. H. Noble at the annual meeting held in San Francisco, March 16, is as follows: "Although the past year of our company has not been as prosperous as gave promise at the beginning of the year, yet considering the financial conditions of the country we can congratulate ourselves on the very substantial gain of $82,231.90 in our gross earnings over the previous year. Had not the price of copper dropped to the very low price that it did, we would have earned at least $50,000 additional. When copper declined from 25½ cents to 11½ cents per pound, the Mountain Copper Company and Great Western Company were compelled to shut down their smelters; the Mammoth and Bully Hill Companies ceased pushing their construction work as formerly, and the Balaklala shut down after spending over $700,000 on its smelter and being within 60 days of completion.

"The company has installed in this smelter 1585 horsepower in motors, and at its mine 225 horsepower. The Trinity Copper Company also has 350 horsepower in motors installed that will be in use when the Balaklala smelter is completed. In this connection, I have just learned that the company has been financed and that work will be resumed at once. In order to take care of this increased load, we have run a second transmission line from Keswick to Kennet through Coram, about 14 miles in length, and have erected and equipped a large sub-station at Coram for the Balaklala smelter; also a sub-station at the Balaklala mine sufficiently large to take care of the Trinity Copper Company. We have extended our lines to the Sugar Loaf group for the Stauffer Chemical Company, also to Quartz Hill, and a short line to the Milton mine. Owing to the growth of our gas business in Redding we were compelled to build a new gas holder and extend mains at a cost of $11,671.31.

"At Heroult-on-the-Pitt we have put up a substation, where I expect more power will be sold than on all the rest of our system. This is due to the fact that the process of smelting iron ore by electricity has proven a commercial success, and a plant will be installed by the Noble Electric Steel Company just as fast as we can guarantee them power, and only limited in size by the amount of power we can furnish them. The electric pumping plant installed by the Central Irrigation & Canal Company was in operation throughout the summer of last year and proved an unqualified success. The Bully Hill Company will start its new smelter some time before the close of the present month.

"Of the 20 cities and towns that we furnish with light and power, all have shown a material increase, and the number of small pumping plants that have been installed is very gratifying, especially in view of the fact that we have been working on these lines for so many years. At the present time we have many applications that we cannot fill, owing to the long distance which it would be necessary to run our lines. In behalf of our Battle Creek Power Company we have purchased the Hazen property of 2,360 acres, together with water rights on South Battle Creek, which will enable us to develop 5,000 horsepower at a very low cost; also the Willows Water & Light Company, which will add very materially to our income. We have installed a complete new water system for the city of Redding, which is not equalled by any of its size in the State, consisting of a substation with 450 kilowatts in transformers, a pump house equipped with two 150-horsepower motors direct connected to two centrifugal pumps capable of pumping 3,500 gallons per minute to the reservoir.

"We have disbursed $40,000 in dividends during the past year, and reinvested $95,478.82 of our net earnings in land, water rights and extensions.

"Some ten months ago we had arranged to sell $500,000 of our Battle Creek bonds. On the strength of this sale we commenced active construction of the Horseshoe Bend plant of 12,500-horsepower capacity, made contracts for machinery, and had a large force of men at work on the dam, when the financial troubles of the country came on and the party to whom we had arranged to sell the bonds was unable to take them. We were compelled, however, to continue with our work for a number of months in order to save that which had already been done. As a result the indebtedness of the company was increased to an undesirable total, and in November of last year your directors were, reluctantly, compelled to suspend the payment of monthly dividends.

"However, the Mammoth Copper Mining Company has at last started its converters, and we can now calculate on an increase of at least $4,000 per month in its power bill. This and the blowing-in of the Bully Hill smelter will bring our net income for the coming month above $20,000. We also have a good prospect of selling our Battle Creek bonds, and this will put us in a very strong financial position and enable us to pay the accumulated dividends." Earning statements for the year ended February 29, 1908:

Gross earnings	$297,061.00
Operating expenses and fixed charges	165,098.99
Total	$131,962.91
Profit on repair work and sales of material	3,515.91
Net earnings for 12 months	$135,478.82
Dividends paid, eight of $5,000 each	40,000.00
Surplus for 12 months	$ 95,478.82
Surplus March 1, 1907	167,839.46
Surplus March 1, 1908, reinvested in land, water rights and extensions	$263,318.28

The following Board of Directors was re-elected at the annual meeting: H. H. Noble, Edward Coleman, J. Henry Meyer, C. R. Downes and A. S. Carman. After the shareholders' meeting the Board organized, re-electing H. H. Noble, president; J. Henry Coleman, vice-president; the Bank of California, treasurer; Edward Whaley, secretary; E. V. D. Johnson, manager, and W. H. Pearce, assistant secretary.

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